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# Analyses of Alternatives (AoAs): Toward a More Rigorous Determination of Scope

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CLASSIFICATION

# ANALYTIC SERVICES INC.

*Informing decisions that shape the Nation's future*



Analyses of Alternatives (AoAs):  
Toward a More Rigorous  
Determination of Scope

Presented to: 11<sup>th</sup> Annual Acquisition  
Research Symposium, Panel 20

Presenter: George E. Thompson  
May 15, 2014

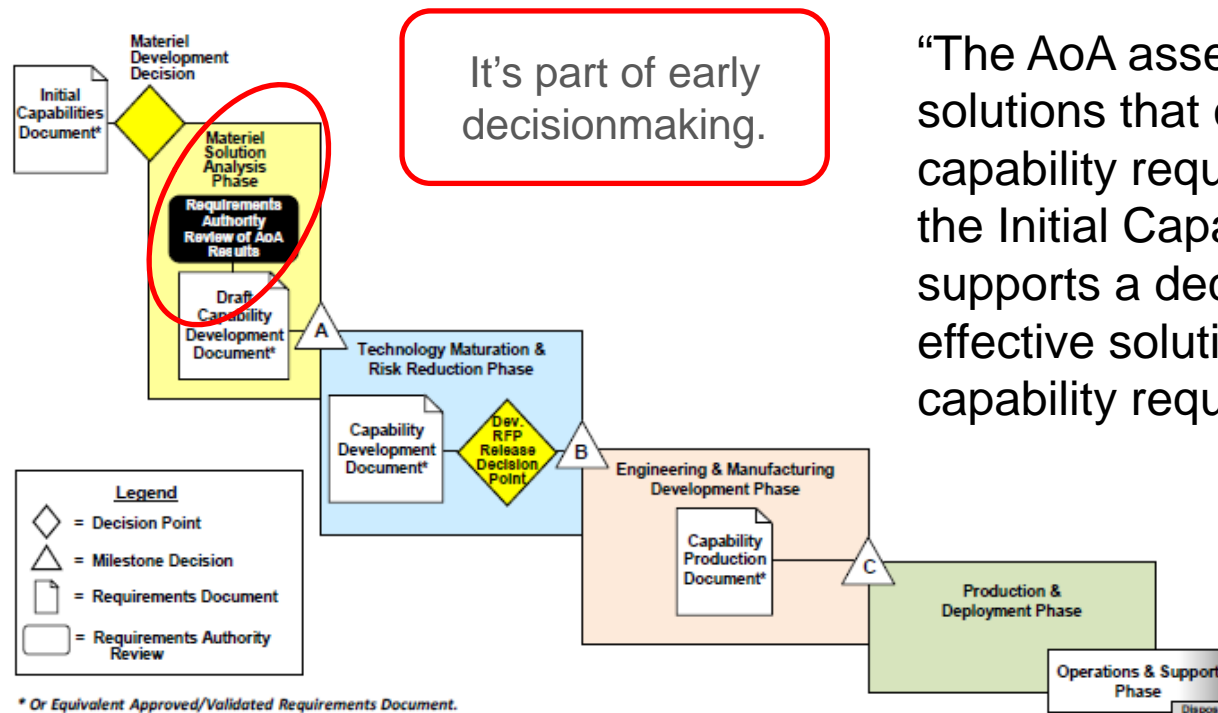
# Motivation

- **Panel Topic:**

*Enabling Affordable Programs through  
Informed Early Decisions*

- **What's AoA got to do with it?**

# Analysis of Alternatives (AoA)



“The AoA assesses potential materiel solutions that could satisfy validated capability requirement(s) documented in the Initial Capabilities Document, and supports a decision on the most cost effective solution to meeting the validated capability requirement(s).”

USD(AT&L). (2013, November 26). *DoDI 5000.02, Operation of the Defense Acquisition System – Interim Instruction*, Figure 1 (p. 5) and Enclosure 9, “Analysis of Alternatives,” paragraph 1.

It initializes the solution trade-space.

“In developing feasible alternatives, the AoA will identify a wide range of solutions that have a reasonable likelihood of providing the needed capability.”

# AoA Scope is Key to Affordability

- **As a matter of policy**

- “Examination of key requirements cost-performance relationships, when merged with affordability analysis results during AoAs, provides the information needed to support sound material solution decisions about affordable products.”

USD(AT&L). (2013, November 26). *DoDI 5000.02, Operation of the Defense Acquisition System – Interim Instruction*, Enclosure 8, “Affordability Analysis and Constraints,” paragraph 3.d.

- **Empirically**

- GAO study of 32 major DoD acquisition programs found strong correlation between AoAs that were “too narrowly scoped” and cost growth in the subsequent programs.

Government Accountability Office. (2009, September). *Defense Acquisitions: Many [AoAs] Have Not Provided a Robust Assessment of Weapon System Options* (GAO-09-665), pp. 7-12.

AoA: an element of early decisionmaking that contributes to affordability by properly characterizing the solution trade-space.

# NPS Grant N00244-13-1-0036

## ■ Problem

- Most AoAs are poorly scoped (GAO, 2009: 13 of 22)\*
- Little or no guidance on this topic is available

## ■ Research goal

- Identify guiding principles that can help improve AoA scoping
- Ensure those principles are rooted in sound analysis

## ■ Approach

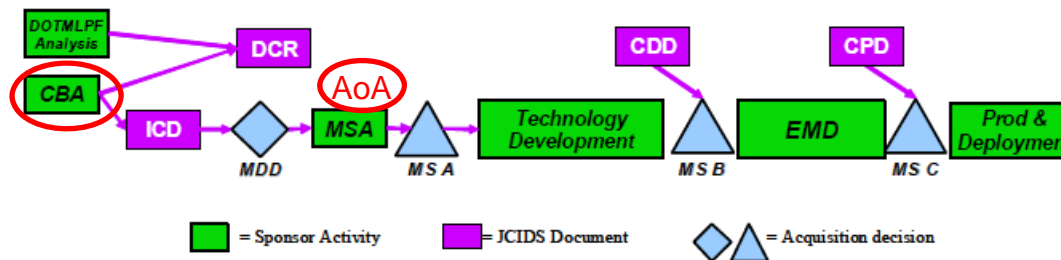
- Review documents (instructions, guidance, handbooks, etc.)
- Interview AoA consumers, overseers, practitioners, critics
- Apply systems analysis / systems thinking methods and tools

\*These findings predate Weapon Systems Acquisition Reform Act of 2009, Pub. L. No. 111-23, 123 Stat. 1704 (2009). However, the effect of WSARA reforms on AoA scoping is not yet clear.

# NPS Grant N00244-13-1-0036 (cont)

## ■ Scope

- Not limited to acquisition process *per se*: includes articulation of capability requirements and gaps per Joint Capability Integration and Development System (JCIDS)



Chairman, Joint Chiefs of Staff. (2003, June 24). *Operation of the Joint Capabilities Integration and Development System* (CJCS 3170.01).

- Acknowledges the importance of several factors that are not addressed in recommendations
  - Organizational roles and responsibilities
  - Institutional culture
  - Predilections of individual decision makers and executives

# What is a “Poorly Scoped” AoA?

- **Two types (not mutually exclusive)**
  - Too narrow: excludes one or more alternatives that *should* be considered (danger: excludes viable portion of trade space)
  - Too broad: includes one or more alternatives that *need not* be considered (danger: impairs effective decisionmaking)
- **How can we tell?**
  - “Should [not] be considered” means “might have been [or would never be] preferred by a ‘reasonable decisionmaker’ ”
  - Identify the improperly excluded [or included] alternative(s) and show that the rationale (if any) is specious
- **Note**
  - Identifying problems prospectively requires tracking upper and lower bounds of probable costs and benefits *during* AoA



# What Causes Poor Scoping?

- **Inappropriate response to time constraints**
  - Post-WSARA push to shorten acquisition timelines\*
  - This can have both positive and negative effects
- **Focus on a single warfighting domain**
  - Nature of capability as described in ICD often makes choice of lead Service – and nature of solution – “obvious”
  - “If the capability gap originated with the Air Force, the solution is going to have wings; if it originated with the Navy, it will have something to do with the water...”

\*Notably, current goals include reducing typical AoA duration from 16-24 months to 6-9 months.  
Source: stakeholder interviews.

# What Causes Poor Scoping? (cont)

- **Focus on existing weapon systems and CONOPs**
  - The “[System xyz] Replacement AoA”: *must* the new solution be another [xyz]-like system?
  - Variant: the “Step 1 Replacement System AoA” (see diagram)
- **Extraneous issues**
  - Hot topics that “must” be considered
- **Lack of process agility**
  - “4 months to get a waiver to save 3 months of wasted effort”

The “Step 1 Replacement System AoA” will discard Alt B...

	Effectiveness		
	Base Case	Alt A	Alt B
Step 1	0.80	0.90	0.75
Step 2	0.60	[no change]	0.95
Overall Outcome*	0.48	0.54	0.71

\*Effectiveness of Step 1 x effectiveness of Step 2

...even though it could significantly improve overall outcomes

# Applying a Systems View



Boardman, J., & Sauser, B. (2008). *Systems Thinking: Coping with 21st Century Problems*. Boca Raton, FL: CRC Press.

We focused on four of the seven Conceptagon triplets

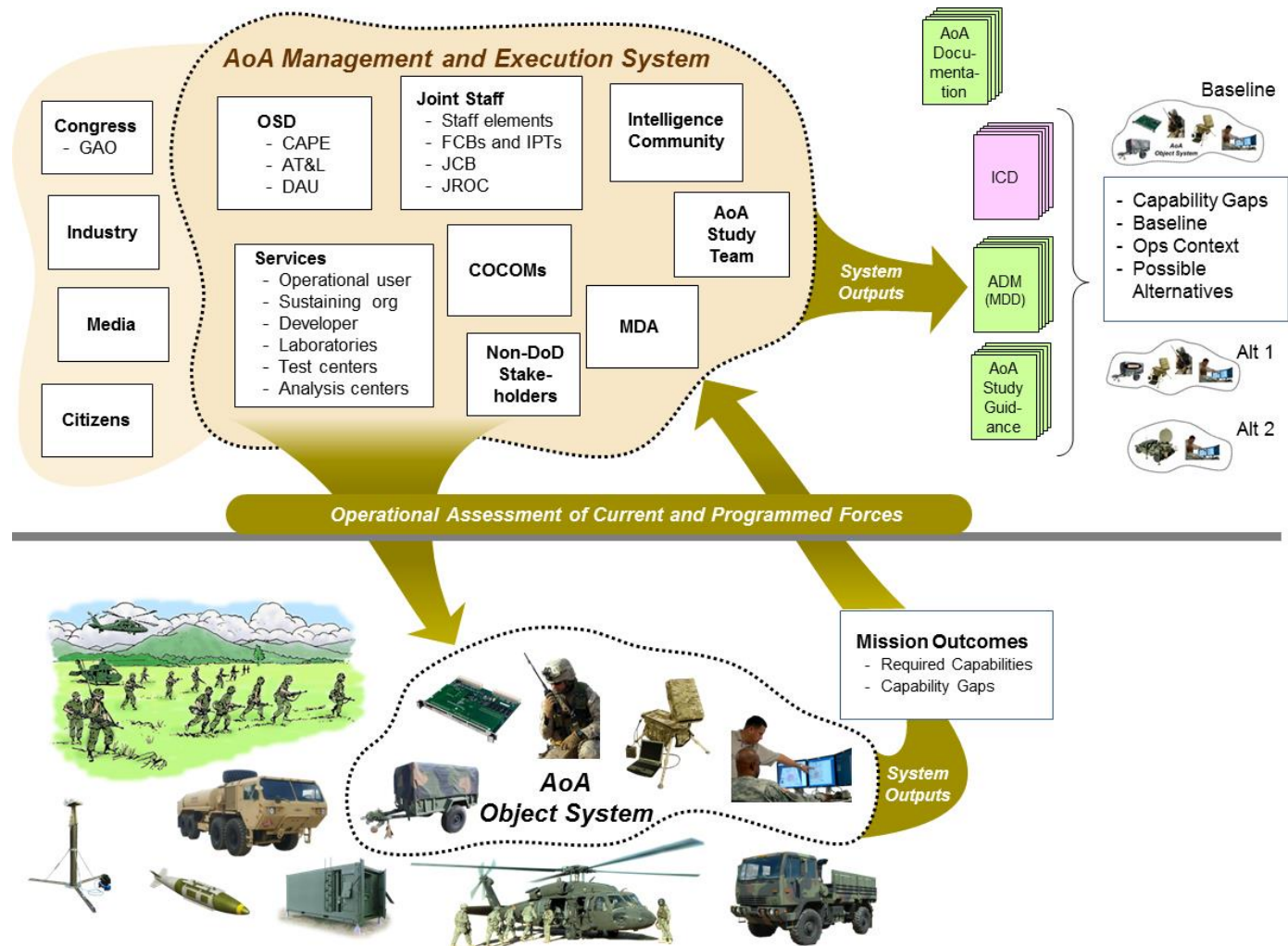
- What system(s) are we analyzing?
- What dimensions of system boundaries must we consider?
- What roles do the “big 3” DoD decision support systems (JCIDS, PPBES, DAS) play?
- How do system inputs, constraints, and enablers shape decisions about AoA scope?

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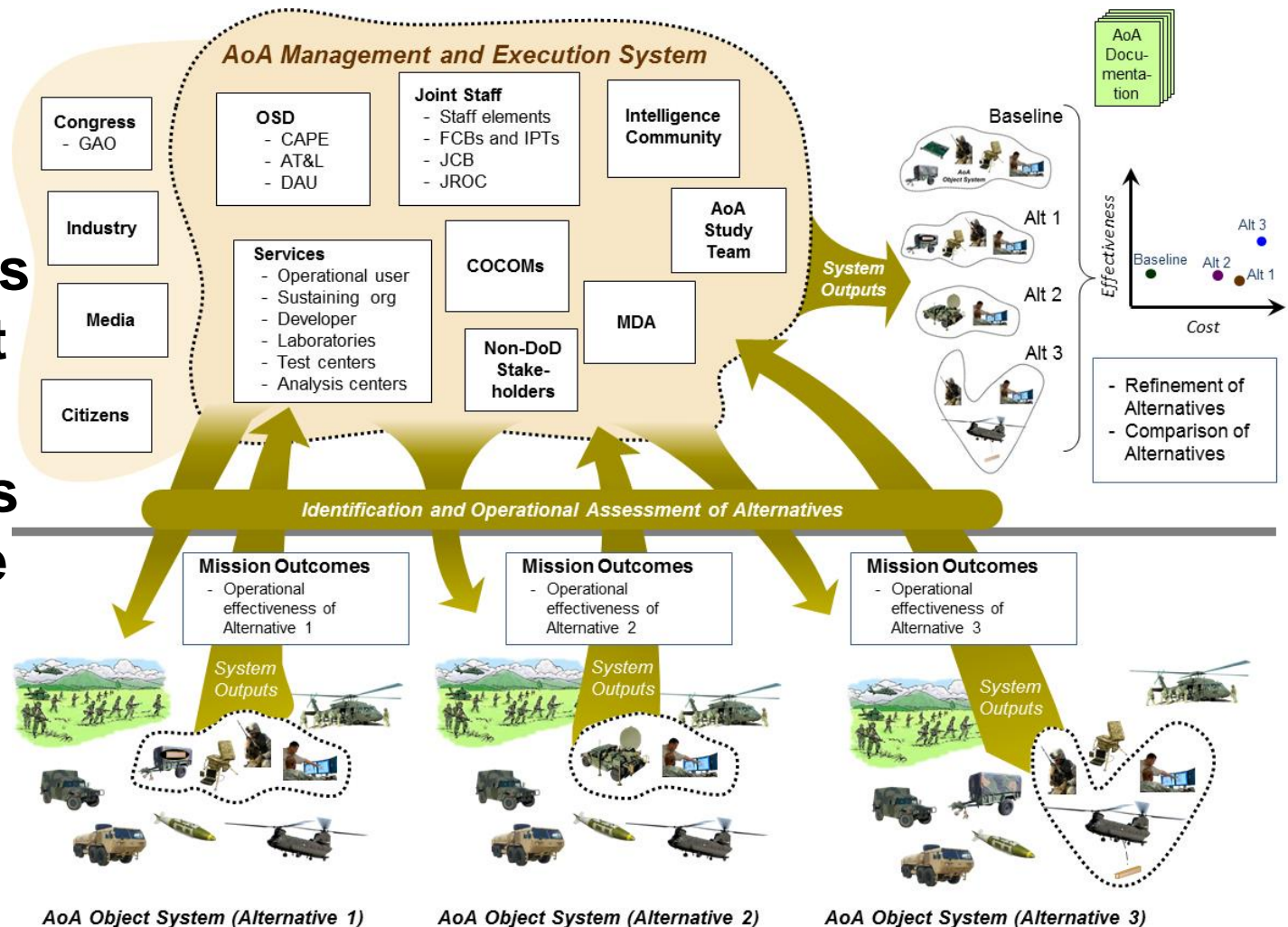
# The Two AoA Systems (Prior to AoA Execution)

- AoA scope is a property of a system output
- It is shaped by how one system thinks about the boundaries of another system



# The Two AoA Systems (During AoA Execution)

- Alternatives are possible instantiations of the Object System
- AoA scope is the envelope of the boundaries of all the alternatives

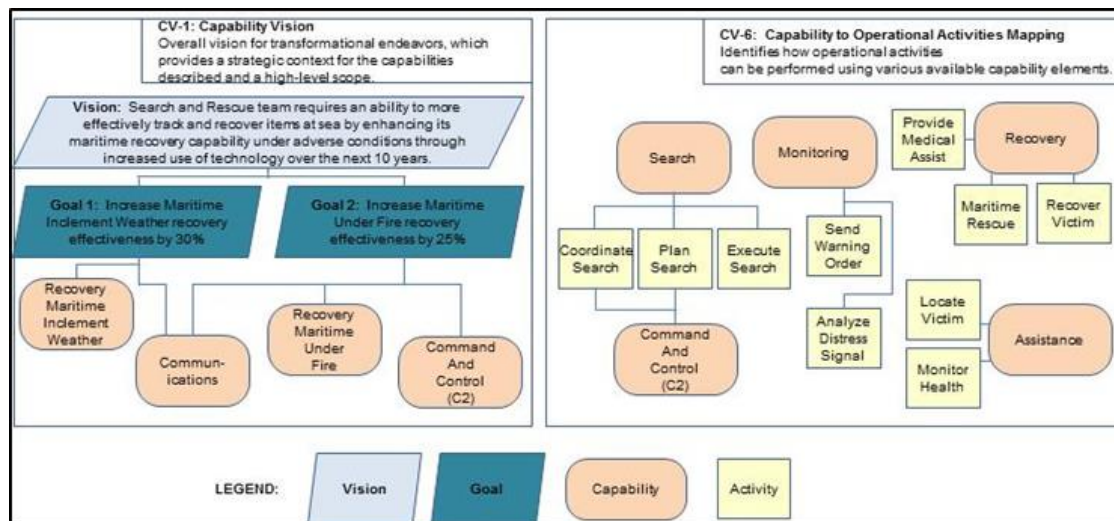




# Guiding Principles

## 1. Focus on outputs (mission outcomes); think backwards

- Problem: no way to think about capability gaps w/o thinking about current and programmed forces; i.e., specific weapon systems
- Remedy: identify alternative sets of activities for capability gaps (use tools such as DODAF)



Wayson, M. (2010, May 11). *DoDAF V2.0 Update*, Presentation slides 9 and 14. [http://dodcio.defense.gov/Portals/0/Documents/DODAF/DoDAF2-0\\_update.ppt](http://dodcio.defense.gov/Portals/0/Documents/DODAF/DoDAF2-0_update.ppt)

- “A capability is the ability to execute a specified course of action...”
- Capability requirements [should be] described in relation to tasks, standards, and conditions....
- [They] should be general enough so as not to prejudice decisions in favor of a particular capability solution...”

Chairman, JCS. (2012, Jan 19). *Manual for the Operation of the Joint Capabilities Integration and Development System*, GL-7, B-11.

# Guiding Principles (cont)

## 2. Start from the exterior; work inwards

- Typically, we start with an example Object System and ask “what else is integral & within decisionmaker’s sphere of authority?”
- Counterexample (need to improve autonomous navigation capabilities of an aircraft): what’s *not* included: the platform? the fire control system? ...

## 3. Question constraints – what would it take to change?

- Affordability: should the programmed force be different? (Genesis of current initiative to prioritize capability needs based on reviews of weapon system portfolios.)
- Alternative technologies: should decision authority be changed?

## 4. Iterate and reduce uncertainty

- Necessary to identify scoping problems prospectively

# Guiding Principles - Summary

- When it comes to proper AoA scoping, systems thinking is not just for systems analysts!

Who \ When	Identification of Capability Gap	Development of AoA Guidance	Execution of AoA	Post-AoA (Review / Implementation)
AoA Decisionmakers	—	1 3	1 4	4
Users, Test Centers	1 2 3	1 2 3	1 4	1 4
DoD Process Owners	1 2 3	1 2 3 4	1 4	1 4
AoA Study Team	—	1 2 3	1 2 3 4	1 4
Acquirers, Developers, Labs	—	4	1 2 3 4	1 2 3 4

1 Focus on Outcomes and Think Backwards

2 Start with the Exterior and Work Inwards

3 Apply Constraints Carefully

4 Iterate and Reduce Uncertainty



# Questions?

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Thank you! For further information...

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